SPAJ 160 C
Capacitor protection relay

User´s manual and Technical description

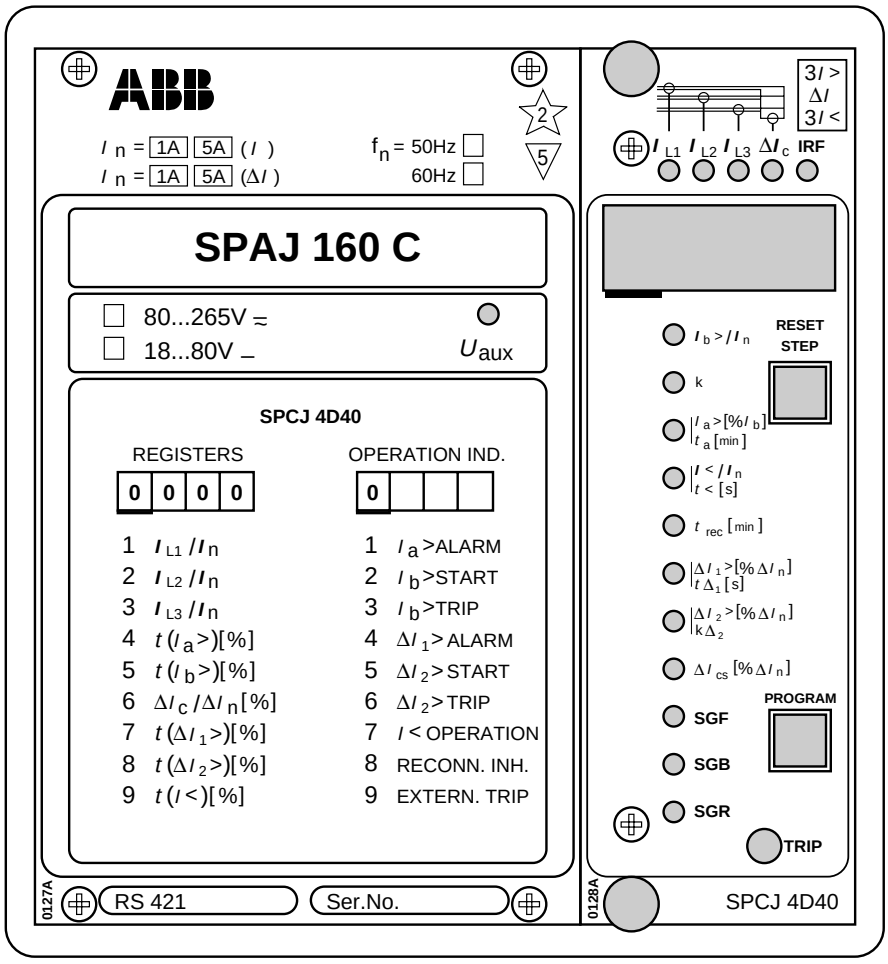


ABB Automation

1MRS 750064-MUM EN

Issued 95-05-02
Modified 97-10-16
Version D
Checked GL
Approved YK

Data subject to change without notice

SPAJ 160 C
Capacitor protection relay

Contents

Characteristics 2
Area of application *(modified 97-10)* 3
Description of operation *(modified 96-11)* 5
Connection diagram 7
Connections 9
Control signals between modules 10
Abbreviations of signal names 11
Operation indicators 12
Power supply and output relau module 14
Technical data *(modified 96-11)* 15
Maintenance and repairs 18
Spare parts 18
Ordering numbers 18
Dimensions and instructions for mounting 19
Information required with order 19

The complete user's manual also includes the following documents:

General characteristics of D-type relay module	1MRS 750066-MUM EN
Capacitor bank relay module type SPCJ 4D40	1MRS 750065-MUM EN

Characteristics

One-, two- and three-phase overload stage with definite time charcteristic

One-, two- and three-phase overload stage with inverse (ANSI) time charcteristic

Phase unbalance protection stage with definite time charcteristic

Phase unbalance protection stage with inverse time charcteristic

Undercurrent protection for detection of capacitor disconnection. Reconnection time with wide setting range

Compensation for natural unbalance current

Fully selectable output relay configuration

Easy selection of appropriate operational scheme for various applications

Numerical display of setting values, current measured values, memorized values etc.

Continuous self-supervision of hardware and software

Optical serial communication over the SPA bus provides access from a higher level central unit to all set and measured values and to memorized fault values. Various events can also be selected to be automatically read by a control data communicator and printed out.

Area of application
(modified 97-10)

The main application area for the relay is to protect capacitor banks intended for reactive power compensation and filtering of the harmonics.

The capacitor banks are usually protected against overload produced by harmonic currents and overvoltage caused by internal faults in the bank. A protection against reconnection of a charged capacitor to a live network should also be included. All these functions can be found in SPAJ 160 C.

An earth-fault and overcurrent protection is often used for selective network protection. In this case an overcurrent and earth-fault protection relay from the SPACOM-family can be connected to the same current transformer as SPAJ 160 C.

Application examples

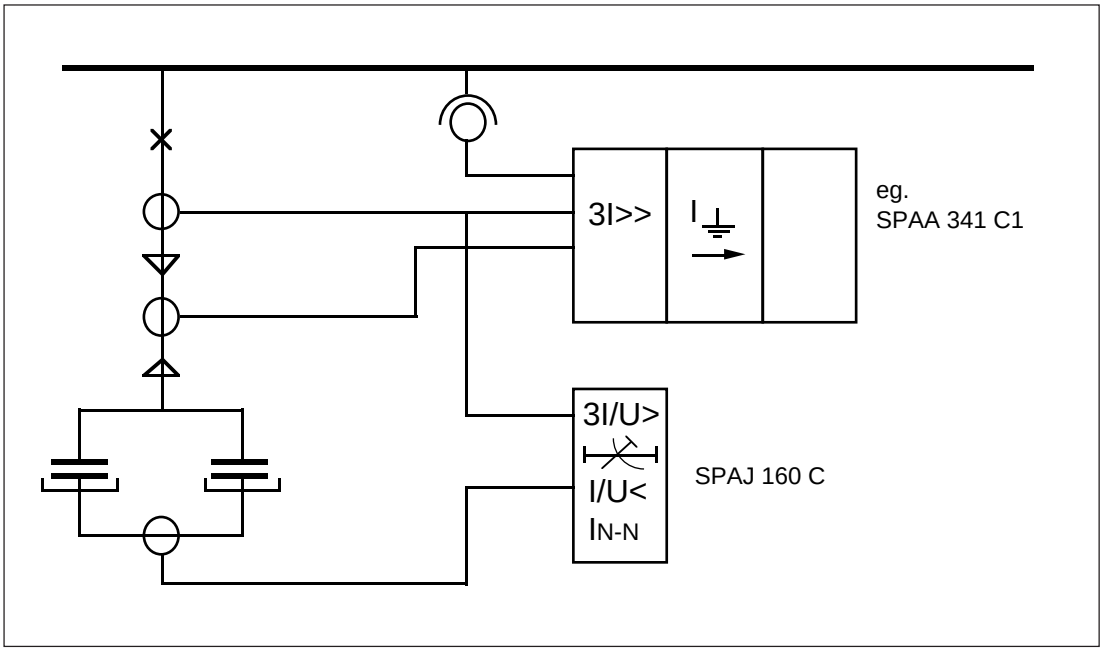


Fig.1. Protection of a capacitor bank connected as a double-star in a distribution network with three-phase current measurement.

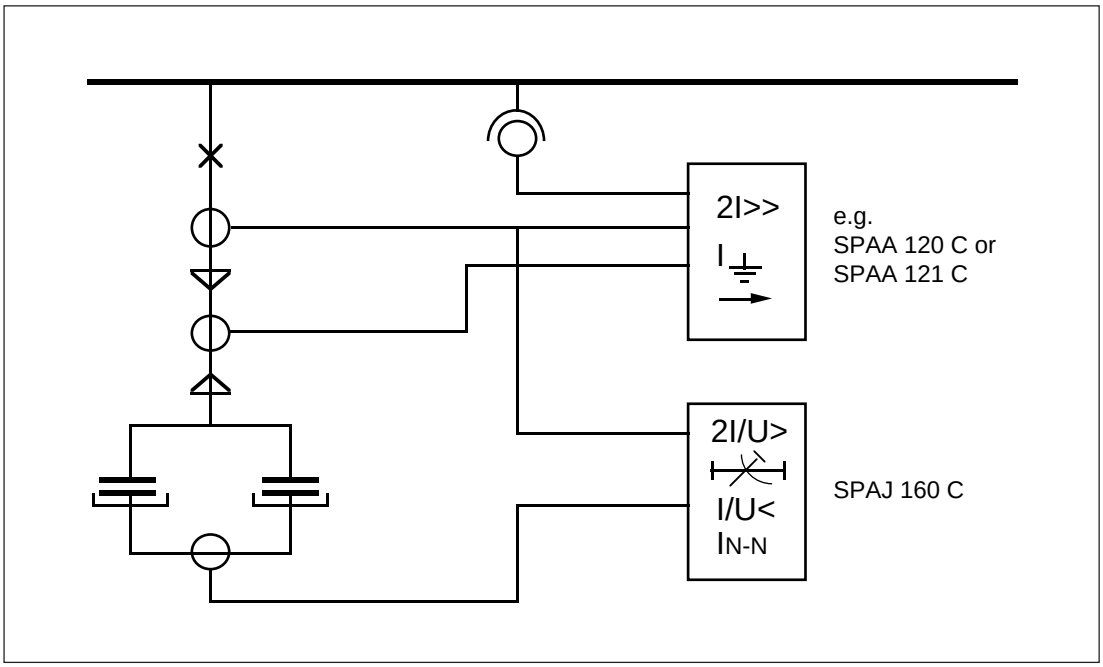


Fig.2. Protection of a capacitor bank connected as a double-star in a distribution network with two-phase current measurement.

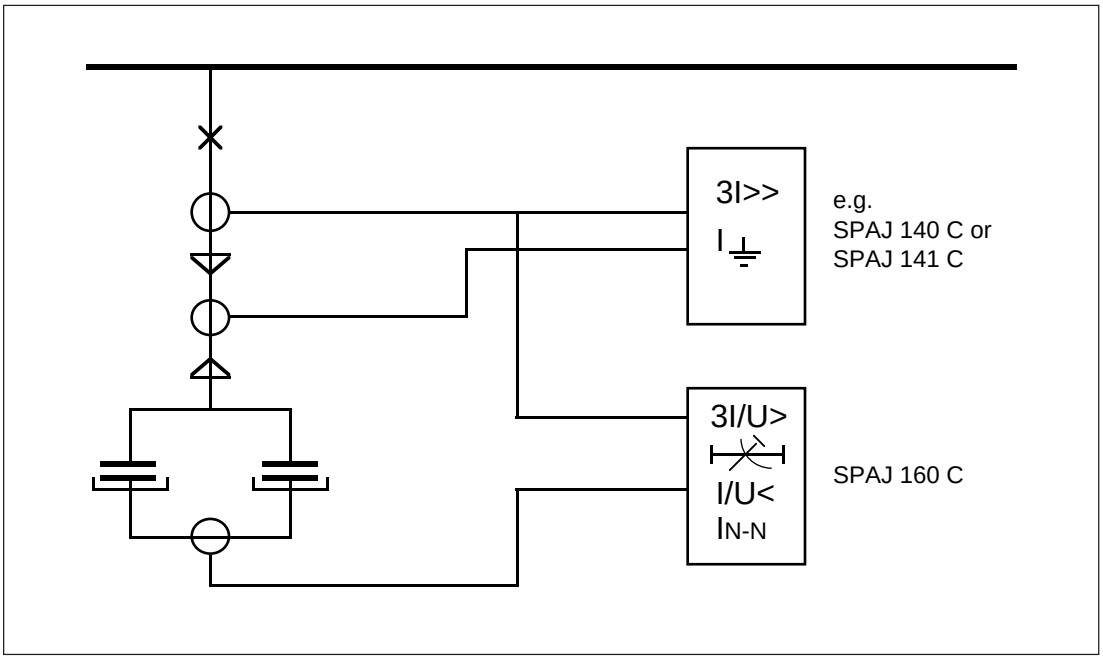


Fig.3. Protection of a capacitor bank connected as a double-star in an industrial network with two- or three-phase current measurement. In this case a non-directional earth-fault protection is used.

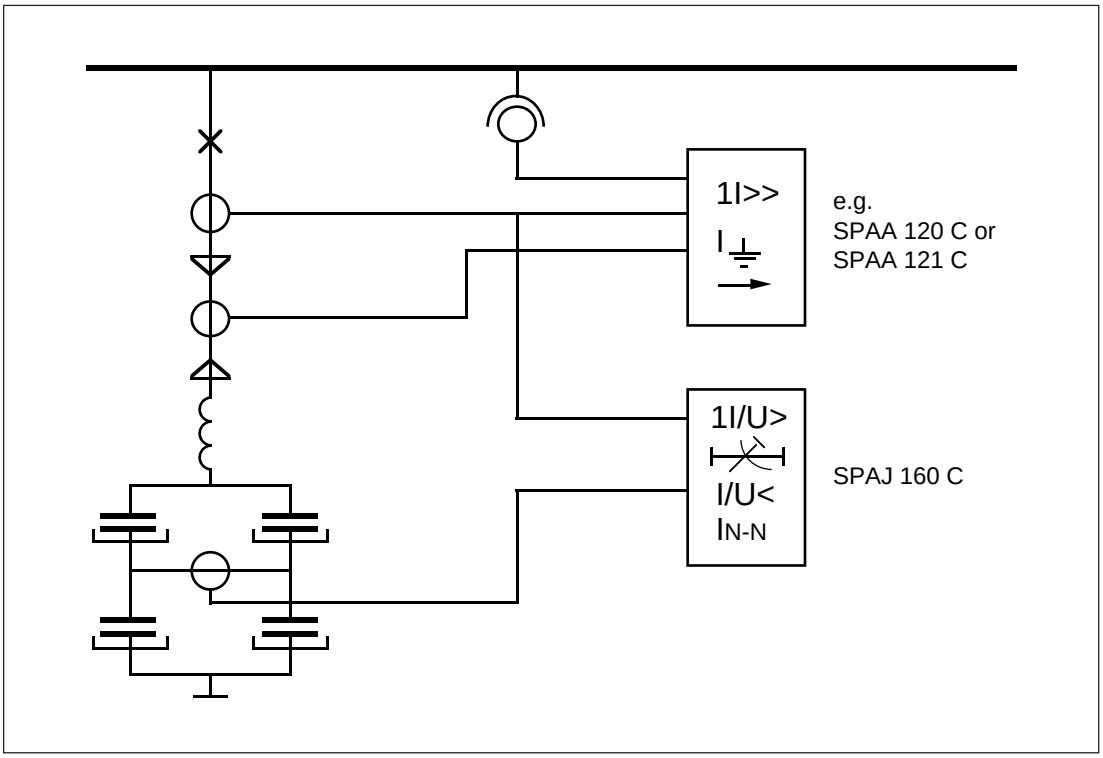


Fig.4. Protection of a one-phase bridge connected capacitor filter bank.

Description of operation
(modified 96-11)

The protective relay measures the phase currents of the capacitor bank one-, two- or three phase. The currents are internally transformed by the relay to signals that will be directly proportionally to the voltages over the bank.

The relay is also measuring the unbalance current that may arise in a capacitor bank. The input current is in this case measured by a current transformer connected between the starpoints in a double-star connection according to fig. 5 or between the branches in a single-phase bridge connection according to fig. 6.

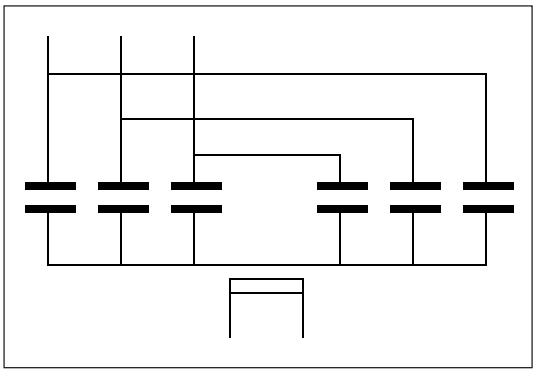


Fig. 5.

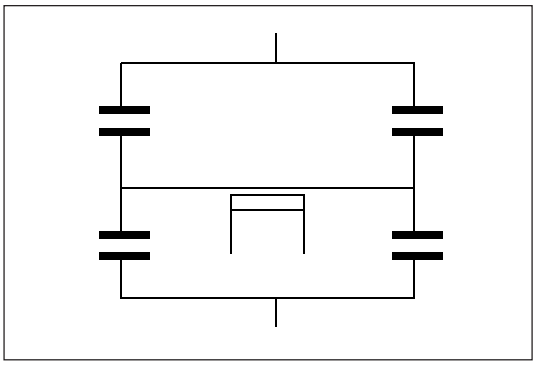


Fig. 6.

The protective relay is a multifunction type of relay and includes functions for overload protection, unbalance protection and undercurrent protection combined with reconnection inhibit to prevent reconnection of a charged capacitor bank to a live network.

The overload protection is mainly a overvoltage protection. It measures peak values with the measured harmonics up to and including the 13th order. The overload protection includes two stages. One stage is alarming and the other is for tripping. The trip stage is based on inverse time characteristic and the inverse curve is based on ANSI/IEEE C37.99 and IEC 871-1 recommendations for the capacitor banks voltage withstand related to time. The gradient of the curve can be changed by a k-factor within the range 0.2...2.0.

The alarm stage has a definite time characteristic. Both the starting value and the operating time are available for setting. To match the relay to the rated current of the capacitor bank a correction setting value is available. By using this setting value it is possible to multiply the signal from the current transformers by a factor within the range 0.30...1.50.

The undercurrent protection, operating with definite time characteristic, is detecting a possible undercurent in the capacitor bank. When all three phase currents are opeating below the starting value and the operating time has elapsed the output alarm will be activated. The reconnection inhibit function connected to the undercurrent protection will be activated at the same time. The reconnection inhibit signal will be active until the set time has elapsed and is used to inhibit the reconnection of a charged capacitor bank to a live network. Both the starting value and the operating time for the undercurrent protection and the setting time for the reconnection inhibit are available for setting.

The unbalance protection measures only the basic frequency component of the current. The protection function includes two stages of which one is alarming and the other tripping. To improve unbalance detection in the capacitor bank the relay is provided with a settable compensation of natural unbalance. Both the amplitude and phase angle are compensated. The trip stage is based on inverse time characteristic and the curve has similar gradient to the normal inverse curve.The starting value can be set within the range 2...80% of the nominal input current of the relay. The gradient of the curve can be changed by the k-factor within the range 0.1...1. It is possible to increase the inverse characteristic time by a factor 10 by setting switch SGF/6 to position 1.

The signal stage has a definite time characteristic. Both the starting value and the operating time are available for setting. By using the unbalance compensation natural unbalance currents within the range 1...20% of the relays nominal input current can be compensated.

By appropriate programming of the output relay matrix, various starting, alarm or reconnection inhibit signals are received as contact functions. This contact information is used e.g. for the blocking of co-operating protective relays located upstream, for connection to annunciation units etc.

The capacitor bank relay contains one external logic control input, which is activated by a control signal of the auxiliary voltage level. The influence of the control input on the relay is determined by programming switches of the measuring module. The control input can be used either for blocking one or more of the protective stages, for carrying out an external trip order, for inhibiting a reconnection attempt or/ and for resetting a latched output relay in the manual reset mode.

The protective relay is provided with a man-machine interface on the front panel. The man-machine interface shows relay activation's, measured values, maximum value registrations, starting counters, time counters and setting values.

All changes of setting values can be made by using the push-buttons on the front panel. Through the serial bus the man-machine communication can be obtained either by using a PC with a setting tool program, a SCS local control system or a microSCADA remote control system.

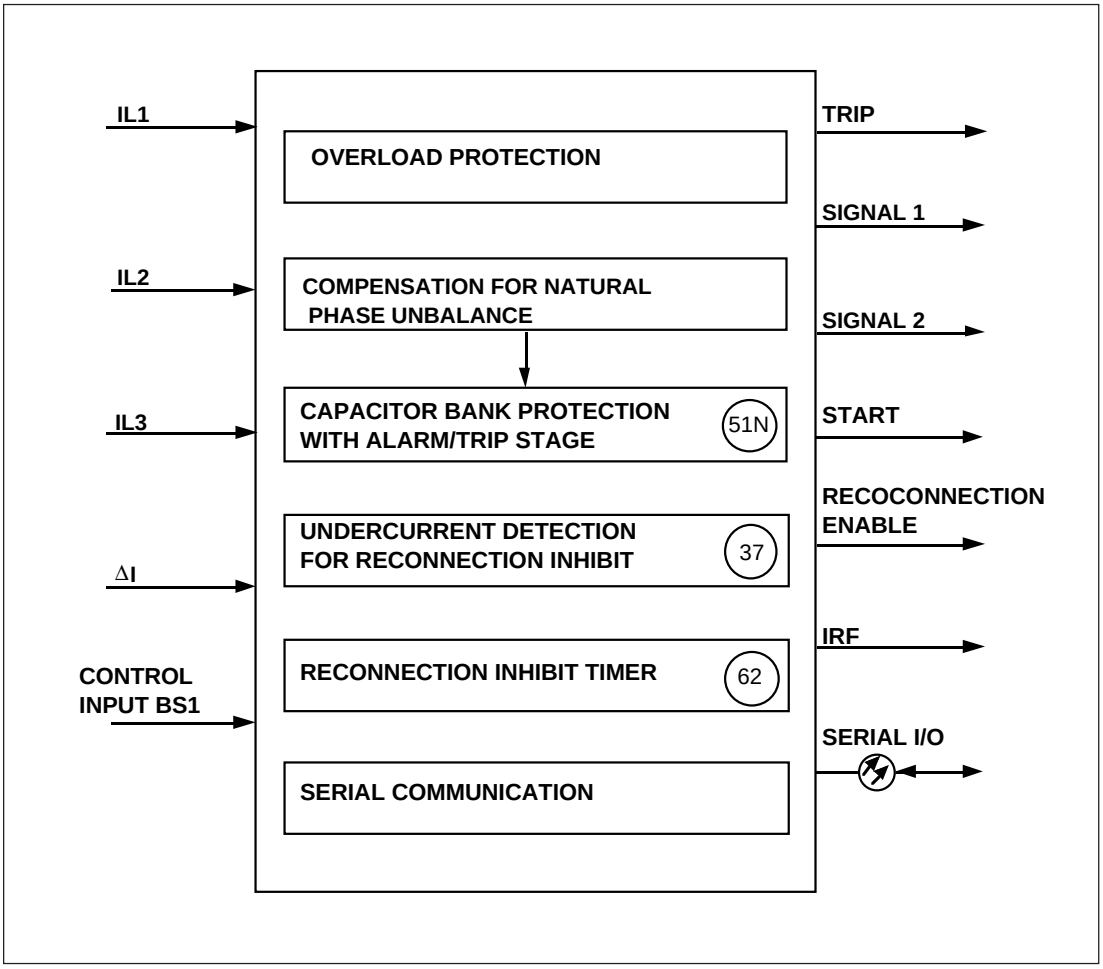


Fig. 7. Checking functions of the capacitor bank overload and unbalance prot. relay type SPAJ 160 C.

Connection diagram

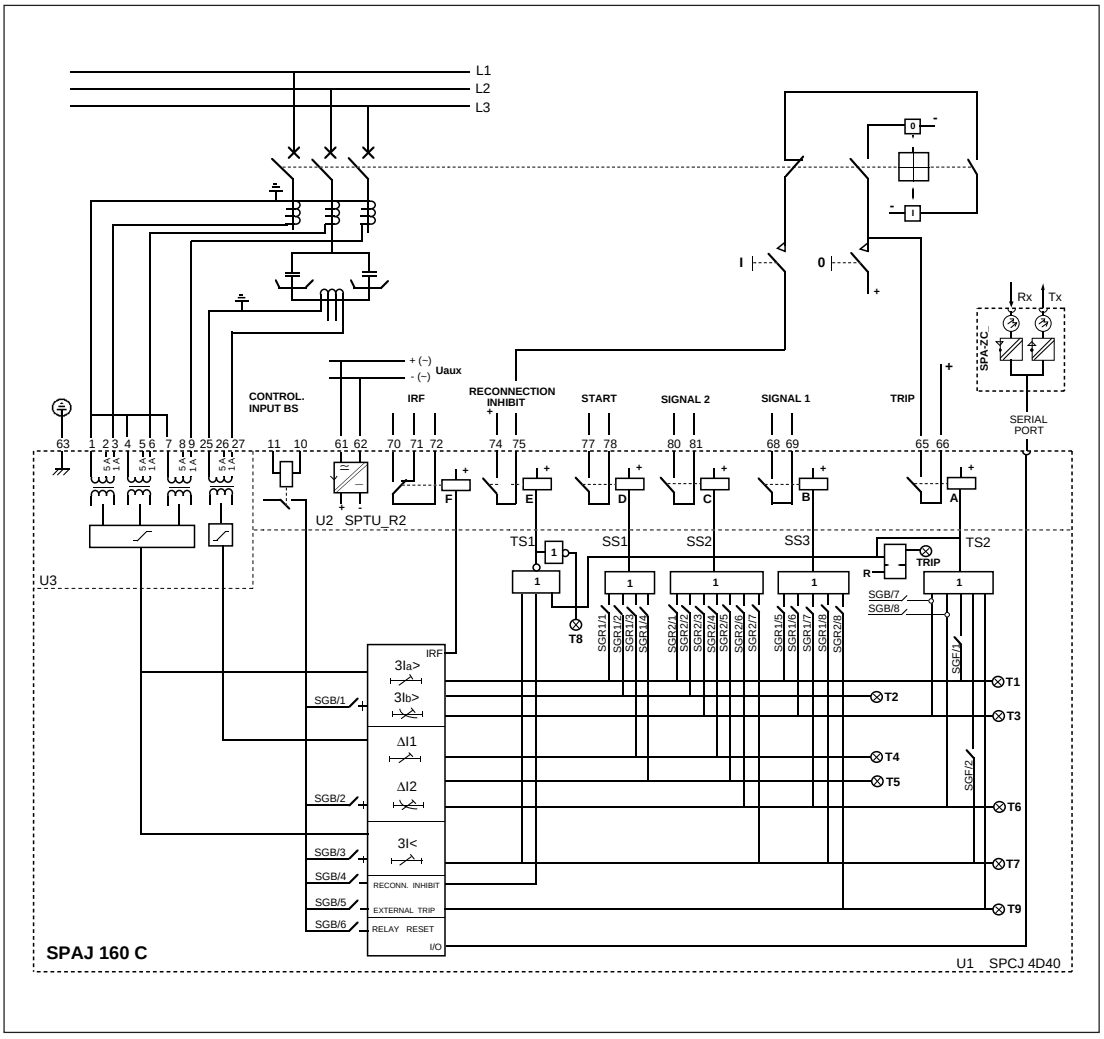


Fig. 8. Complete connection diagram for the capacitor bank protection relay SPAJ 160 C with all the relay matrix and blocking/control input programming switches shown.

U_{aux}	Auxiliary voltage
A, B, C, D, E, F	Output relays
IRF	Self-supervision
SGB1	Switchgroup for the configuration of the blocking and control signals
TRIP	Trip output relay, output 65-66
SIGNAL 1	Signal on tripping
SIGNAL 2	Signal on tripping
START	Signal on starting
RECONN. INHIBIT	Connection inhibited in fault conditions
U1	Capacitor bank protection relay module SPCJ 4D40
U2	Power supply and output relay module SPTU 240 R2 or SPTU 48 R2 with a normally open trip contact
U3	Input module SPTE 4E3
Rx Tx	Serial communication interface
T1...T9	Operation indications
SPA-ZC-	Bus connection module

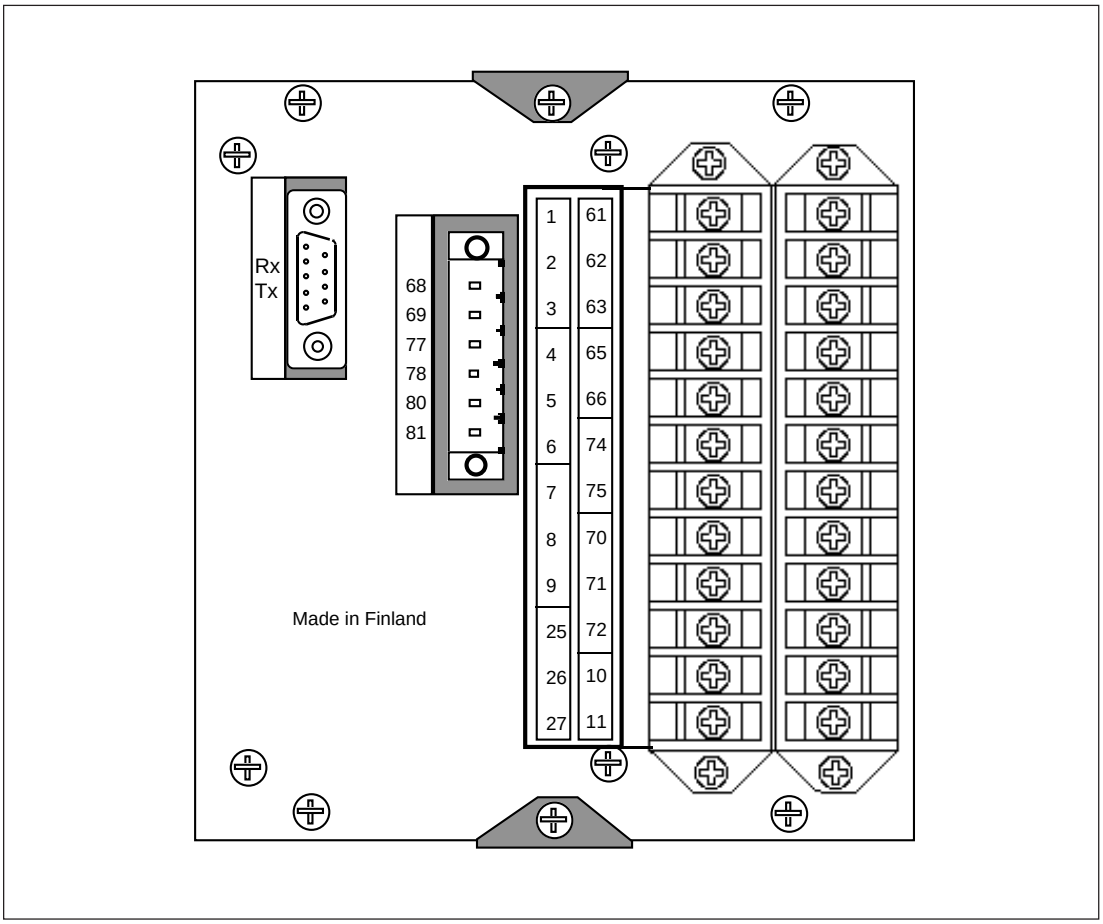


Fig. 9. Rear view of relay SPAJ 160 C

Connections

Terminal	Function
1-2	Phase current I_{L1}, 5 A
1-3	Phase current I_{L1}, 1 A
4-5	Phase current I_{L2}, 5 A
4-6	Phase current I_{L2}, 1 A
7-8	Phase current I_{L3}, 5 A
7-9	Phase current I_{L3}, 1 A
25-26	Phase unbalance current 5 A
25-27	Phase unbalance current 1 A
61-62	Auxiliary supply voltage. At d.c. auxiliary supply voltage the positive lead is connected to terminal 61.
63	Protective earth
10-11	Blocking- and control input. Can be used as an external blocking input inhibiting overload, phase unbalance or undercurrent protection. As an control input it can be used for an external trip signal, for unlatching the trip relay and for the reconnection inhibit relay. The function is selected with SGB-switches in the protection relay module.
65-66	Output relay A is a heavy duty relay which provides CB tripping commands. A latching function of the output relay A can be selected by means of switches SGB1/6 and SGB1/7. Switch SGB1/6 gives a latching function after an overload tripping. Switch SGB1/7 provides a latching function after a phase unbalance trip. The latched output relay can be reset locally or by remote control. The undercurrent unit can be made tripping with switch SGF/2. Also the overload stage $I_a>$ can be made tripping with switch SGF/1.
68-69	The signals to be routed to output relays B and C are selected with switches 5...8 of 80-81 switchgroup. The signals to be routed to output relays B and C are selected with switches 5...8 of switchgroup SGR1 and switches 1...8 of switchgroup SGR2 of the measuring module. Normally overload stage $I_b>$ start signal is linked to relay C and the overload stage $I_a>$ alarm signal is linked to output relay B.
77-78	The signals to be routed to the output relay D are selected by means of switches 1...4 of switchgroup SGR1. Switch SGR1/1 links the overload $I_a>$ alarm, switch SGR2/2 links the oveload $I_b>$ start, switch SGR2/3 links the phase unbalance alarm of stage $\Delta I_1>$ and switch SGR2/4 links the phase unbalance start signal of stage $\Delta I_2>$ to output relay D.
74-75	Output relay E is a heavy duty output relay capable of controlling a circuit breaker. Relay E is normally used for controlling the reconnection of the capacitor bank. If the reconnection inhibit signal is active the output relay E prevents a reconnection attempt of the capacitor bank. This also applies to a condition where the protective relay is out of auxiliary voltage or the relay is faulty.
70-71-72	Output relay F operates as an self-supervision output relay. Under normal conditions the relay is operated and the contact gap 70-72 is closed. If a fault is detected by the self-supervision system, or if the auxiliary supply fails, the output relay drops off, providing an alarm signal by closing the NO contact 71-72.

The relay is interfaced with the SPA serial communication bus through a 9-pole, D-type subminiature connector located at the rear panel of the relay. By means of the bus connection modules SPA-ZC21 or SPA-ZC17 the relay can be linked to the serial bus and further to a control data communicator, e.g. SACO 148D4 or SRIO 500/1000M.

Control signals between the modules

The figure below schematically illustrates how the closing and alarm signals are connected between measuring and output relay module.

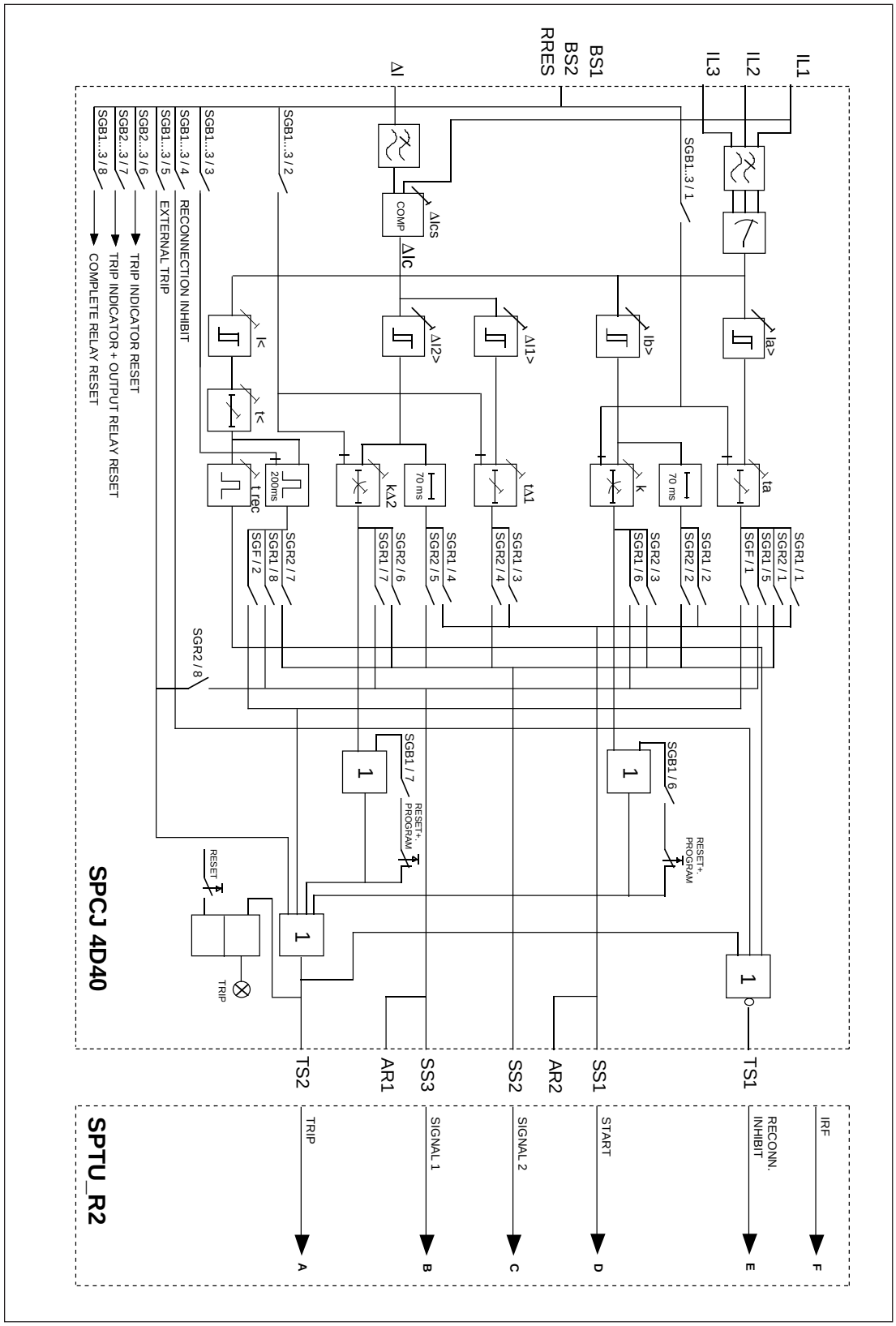
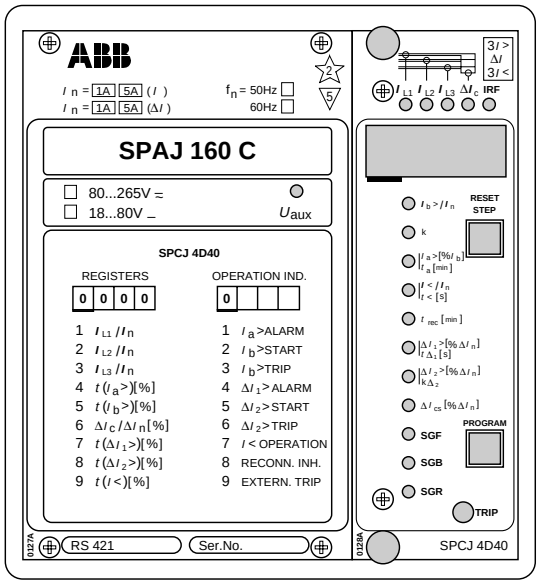


Fig. 10. Control signals between the modules of the capacitor bank relay SPAJ 160 C.

The functions of the blocking, starting and tripping signals are selected with the switches of switchgroups SGF, SGB1...3 and SGR1...2. The checksums of the switchgroups, are found in the setting menu of the measuring relay module. The functions of the different switches are explained in the user's manual of the measuring module SPCJ 4D40.

Abbreviations of signal names

I_{L1}, I_{L2}, I_{L3}	Phase currents
ΔI	Phase unbalance current
ΔI_c	Compensated phase unbalance current
BS1, BS2 ,RRES	External blocking or resetting signals
SS1	Starting Signal 1
SS2	Starting Signal 2
SS3	Starting Signal 3
TS1	Tripping Signal 1
TS2	Tripping Signal 2
AR1...3	Auto-Reclose starting signals (not used in SPAJ 160 C)
IRF	Internal Relay Fault signal
SS1	Starting Signal 1
SGF	Switch Groups for functions
SGB1...3	Switch Groups for blockings
SGR1...2	Switch Groups for relay configuration
Rx/Tx	Receiver/Transmitter channel



A) The indicator TRIP is lit when one of the protection stages operates. When the protection stage returns, the red indicator remains alight.

B) If the display is dark when one of the protection stages $I_a>$ or $I_b>$ request for tripping, the faulty phase is indicated with a yellow LED. If, for instance, the TRIP indicator glows red, and the indicators I_{L1} and I_{L2} are ON at the same time, overcurrent has occurred on phase L1 and L2.

C) Besides being a code number at data presentation, the leftmost red digit in the display serves as a visual operation indicator. An operation indicator is recognized by the fact that the red digit alone is switched on. The operation indication from a start or the reconnection inhibit is always replaced by a new operation indication. On the other hand an operation indication from a stage connected to the trip relay A can not be replaced by a new operation indication. In order to enable reading of actual current levels etc. when reconnection time is running, it is possible to acknowledge the indication 8 while the unit is still activated. The same applies to the external trip indication 9. In these cases the indications are memorized and reappear when the display is dark. Operation indicator 8 is automatically reset when the capacitor bank is reconnected. The following table, named OPERATION IND. on the relay front panel, is a key to the operation indicator code numbers used.

Indication	Explanation	
1	$I_a>$ alarm	= The overload stage $I_a>$ has given an alarm
2	$I_b>$ start	= The overload stage $I_b>$ has started
3	$I_b>$ trip	= The overload stage $I_b>$ has tripped
4	$\Delta I_1>$ alarm	= The stage $\Delta I_1>$ has given an alarm
5	$\Delta I_2>$ start	= The stage $\Delta I_2>$ has started
6	$\Delta I_2>$ trip	= The stage $\Delta I_2>$ has tripped
7	I< operation	= The stage I< has operated
8	t_{rec}	= The reconnection inhibit is active, indication is self-reset
9	EXT.TRIP	= A trip from an external relay has been carried out via the relay

D) The operation indicator on the display and the "TRIP" indicator persist when the protective stage returns to normal. The indicators are reset by pushing the RESET/STEP push-button.

Further, the indicators may be reset via the external control input 10-11 by applying a control voltage to the input, provided that the switch SGB1/8 is in position 1.

The basic protective relay functions are not depending on the state of the operation indicators, i.e. reset or non-reset. The relay is permanently operative.

If stage $I_b>$ or $\Delta I_2>$ starts, but no tripping occurs because the energizing quantity goes below the starting level before the delay circuit times out, the starting indications are automatically switched off. However, by means of the switches SGF/3...4 the starting indications may be persistent which means that they are to be reset by pushing the RESET/STEP push-button. The persistent indications are obtained through the following programming:

Switch SGF/3 = 1 Starting indication on $I_b>$ persistent

Switch SGF/4 = 1 Starting indication on $\Delta I_2>$ persistent

On delivery from factory the switches SGF/3...4 = 0

E) The self-supervision alarm indicator IRF indicates that the self-supervision system has detected a permanent fault. The indicator activates with a red light about 1 minute after the fault has been detected. At the same time the plug-in module delivers a signal to the self-supervision system output relay of the protection assembly. Additionally, in most cases, a fault code showing the nature of the fault appears on the display of the module. The fault code, consists of a red figure one and a green code number, this cannot be erased from the display of the module by resetting. When a fault occurs, the fault code should be recorded and stated when service, is ordered.

Power supply and output relay module

To be able to operate the relay needs a secured auxiliary voltage supply. The power supply module forms the voltages required by the measuring relay module and the auxiliary relays. The withdrawable power supply and output relay module is located behind the system front panel, which is fixed by means of four cross-slotted screws. The power supply and output relay module contains the power supply unit, all output relays, the control circuits of the output relays and the electronic circuitry of the external control signals.

The power supply and output relay unit can be withdrawn after removing the system front panel. The primary side of the power supply module is protected with a fuse, F1, located on the PCB of the module. The fuse size is 1 A (slow).

The power supply unit is a transformer connected, i.e. galvanically isolated primary and secondary side, flyback-type dc/dc converter. It forms the dc secondary voltages required by the measuring relay module; that is +24 V, ±12 V and +8 V. The output voltages ±12V and +24 V are stabilized in the power supply module, while the +5 V logic voltage required by the measuring relay module is formed by the stabilizer of the relay module.

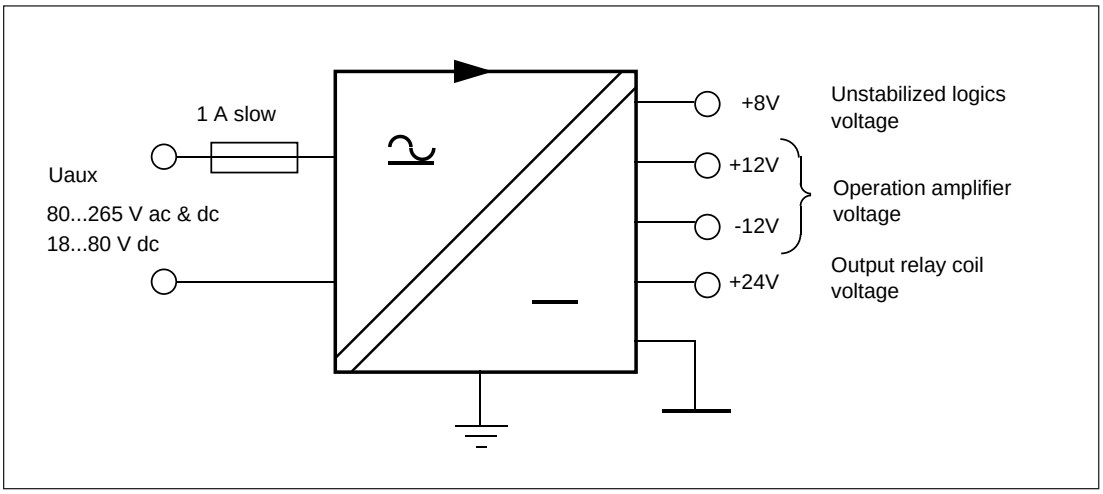


Fig. 11. Voltage levels of the power supply module.

A green LED indicator Uaux on the system front panel is illuminated when the power supply module is in operation. The supervision of the voltages supplying the electronics is placed in the measuring module. If a secondary voltage deviates from its rated value by more than 25 %, a selfsupervision alarm will be established. An alarm is also received when the power supply module is withdrawn from the relay case, or when the auxiliary power supply to the relay is interrupted.

There are two versions of the power supply and output relay modules available. For both types, the secondary sides and the relay configurations are identical, but the input voltage ranges differ.

Insulation test voltage between the primary and the secondary side and the protective earth.
2 kV, 50 Hz, 1min

Rated power P_n 5 W

Voltage ranges of the power supply modules:
- SPTU 240 R2 U_{aux} = 80 ... 265 V ac/dc
- SPTU 48 R2 U_{aux} = 18 ... 80 V dc (on request)

The module SPTU 240 R2 can be used with both ac and dc voltages. Module SPTU 48 R2 is designed for dc supply only. The auxiliary voltage range of the power supply module of the relay assembly is indicated on the system front panel.

Technical data
(modified 96-11)

Energizing inputs

Phase and neutral current inputs, terminals	1-3, 4-6, 7-9, 25-27	1-2, 4-5, 7-8, 25-26
Rated current I_n	1 A	5 A
Thermal withstand capability		
- continuously	4 A	20 A
- for 1 s	100 A	500 A
Dynamic current withstand, half-wave value	250 A	750 A
Input impedance	< 100 mΩ	< 20 mΩ
Phase current monitoring range	0...8.5 x I_n	
Phase unbalance current monitoring range	0...212% ΔI_n	
Rated frequency	50/60 Hz	

Output contact ratings

Reconnection enable and trip contact	
Terminals	65-66, 74-75
- Rated voltage	250 V dc/ac
- Carry continuously	5 A
- Make and carry for 0.5 s	30 A
- Make and carry for 3.0 s	15 A
- Breaking capacity for dc, when the control circuit time-constant L/R < 40ms, at 48/110/220 V dc control circuit voltage	5 A / 3 A / 1 A
Contact material	$AgCdO_2$

Start and signalling contacts	
Terminals	70-71-72, 68-69, 77-78, 80-81
- Rated voltage	250 V dc/ac
- Carry continuously	5 A
- Make and carry for 0.5 s	10 A
- Make and carry for 3.0 s	8 A
- Breaking capacity for dc, when the control circuit time-constant L/R < 40ms, at 48/110/220 V dc control circuit voltage	1A / 0.25A / 0.15A
Contact material	$AgCdO_2$

External control inputs

Blocking and command inputs	10-11
External control voltage level	18...265 V dc or 80...265 V ac
Typical control current of input circuit	2 mA

Power supply and output relay module

Supply and relay module, type SPTU 240 R2	80...265 V dc/ac
Supply and relay module, type SPTU 48 R2	18...80 V dc (on request)
Power consumption under quiescent/operating conditions	4 W / 6 W

Protection units of module SPCJ 4D40

Overload stage $I_b>$	
Starting current $I_b>$	0.30...1.50 x I_n
Starting time	<80 ms
Operation characteristic	ANSI inverse
Time multiplier k	0.2...2.0
Resetting time	<100 ms
Drop-off/pick-up ratio	>0.95
Operation time accuracy ($k = 1.0$ and $I_b> = 0.50…1.50 \times I_n$)	±10% of theoretical value or ±50 ms
Operation accuracy	±3% of set value
Shortest possible trip time	~100 ms
Overload stage $I_a>$	
Starting current $I_a>$	80...120% x $I_b>$
Operating time	0.50...100 min
Resetting time	<250 ms
Drop-off/pick-up ratio	>0.95
Operation time accuracy	±2% of set value
Operation accuracy	±3% of set value
Undercurrent stage I<	
Starting current I<	0.10...0.70 x I_n
Operating time	1.0...100 s
Reconnection time	0.50...100 min
Pulse shaped tripping signal, pulse length	~200 ms
Pick-up/drop-off ratio	<1.1
Operation time accuracy	±2% of set value or ±75 ms
Operation accuracy	±3% of set value within range 0.25...0.70 x I_n
Phase unbalance $\Delta I_1>$, Stage 1	
Starting current $\Delta I_1>$	1.0...100% ΔI_n *)
Operating time	1.0...300 s
Resetting time	<100 ms
Drop-off/pick-up ratio	>0.90
Operation time accuracy ($\Delta I_{cs} = 0$)	±2% of set value or ±75 ms
Operation accuracy ($\Delta I_{cs} = 0$)	±3% of set value within range 1.5...100% ΔI_n
Phase unbalance $\Delta I_2>$, Stage 2	
Starting current $\Delta I_2>$	2.0...80.0% ΔI_n *)
Starting time	<70 ms
Operation characteristic	Inverse time
Time multiplier $k_{\Delta 2}$	0.1...1.0
Resetting time	<100 ms
Drop-off/pick-up ratio	>0.90
Operation time accuracy of theoretical characteristic ($\Delta I_{cs} = 0$)	7.5% or ±35 ms
Operation accuracy ($\Delta I_{cs} = 0$)	±3% of set value
Shortest possible trip time	~100 ms
Setting of compensation	0.0...20.0% ΔI_n
Operation accuracy	<3% of ΔI_n

*) minimum recommended: 3.0% ΔI_n

Data transmission

Transmission mode	Fibre optic serial bus
Data code	ASCII
Data transfer rate, selectable	4800 Bd or 9600 Bd
Electrical/optical bus connection module powered from the host relay	
- for plastic core cables	SPA-ZC 21 BB
- for glass fibre cables	SPA-ZC 21 MM
Electrical/optical bus connection module powered from the host relay or an external power source	
- for plastic core cables	SPA-ZC 17 BB
- for glass fibre cables	SPA-ZC 17 MM

Test voltages *)

Dielectric test voltage according to IEC 255-5	2.0 kV, 50 Hz, 1 min
Impulse test voltage according to IEC 255-5	5 kV, 1.2/50 μs, 0.5 J
Insulation resistance according to IEC 255-5	>100 MΩ, 500 V dc

Disturbance tests *)

High-frequency (1MHz) disturbance test according to IEC 255-22-1, class III	
- common mode	2.5 kV
- differential mode	1.0 kV
Fast transients according to IEC 255-22-4, class III and IEC 801-4, level 4	
- power supply inputs	4 kV, 5/50 ns
- other inputs	2 kV, 5/50 ns
Electrostatic discharge test according to IEC 255-22-2 and IEC 801-2, class III	
- air discharge	8 kV
- contact discharge	6 kV

Environmental conditions

Specified ambient service temperature range	-10 ... +55 ^{o}C
Temperature influence on the operating values of the relay over the specified ambient service temperature range	< 0.2 %/ ^{o}C
Long term damp heat withstand according to IEC 68-2-3	< 95 % at 40 ^{o}C for 56 d/a
Transport and storage temperature range	-40 ... +70 ^{o}C
Degree of protecting by enclosure of the relay case as per IEC 529 when panel mounted	IP 54
Mass of the relay	3.5 kg

*) The insulation and disturbance tests do not apply to the serial port, which is used for the bus connection module only.

Maintenance and repair

When the synchrocheck relay is operating under the conditions specified in the section "Technical data", the relay is practically maintenance-free. The relay modules include no parts or components subject to an abnormal physical or electical wear under normal operating conditions.

If the environmental conditions at the relay operating site differ from those specified, as to temperature, humidity, or if the athmosphere around the relay contains chemically active gases or dust, the relay should to be visually inspected in association with the relay secondary test or whenever the relay modules are withdrawn from the case. At the visual inspection the following things should be noted:

- Signs of mechanical damage on the relay modules, contacts and relay case
- Accumulation of dust inside the relay cover or case; remove by flowing air carefully
- Rust spots or signs of erugo on terminals, case or inside the relay

On request, the relay can be given a special treatment for the protection of the printed circuit boards against stress on materials, caused by abnormal environmental conditions.

If the relay fails in operation or if the operating values remarkable differ from those of the relay specifications, the relay should be given a proper overhaul. Minor measures can be taken by personnel from the instrument work-shop of the customer's company, e.g. replacement of auxiliary relay modules. All major measures involving overhaul of the electronics are to be taken by the manufacturer. Please contact the manufacturer or his nearest representative for further information about checking, overhaul and recalibration of the relay.

Note!
Static relays are measuring instruments and should be handled with care and protected against moisture and mechanical stress, especially during transport.

Spare parts

Capacitor bank protection relay module	SPCJ 4D40
Power and output relay module	
U_{aux} = 80 ... 265 V ac/dc	SPTU 240 R2 for NO trip contact
U_{aux} = 18 ... 80 V dc	SPTU 48 R2 for NO trip contact
Relay box, complete with input module	SPTK 4E3
Input module as separate part	SPTE 4E3
Bus connection module	SPA-ZC 17_ or SPA-ZC 21_

Ordering numbers

Capacitor bank protection without testswitch

SPAJ 160 C	RS 611 051 - AA, CA, DA, FA

Capacitor bank protection with testswitch type RTXP 18

SPAJ 160 C	RS 611 251 - AA, CA, DA, FA

The last letters of the ordering number indicate the rated frequency f_n and the auxiliary voltage range U_{aux} of the relay as follows:
AA equals f_n = 50 Hz and U_{aux} = 80...265 V ac/dc
CA equals f_n = 50 Hz and U_{aux} = 18...80 V ac/dc
DA equals f_n = 60 Hz and U_{aux} = 80...265 V ac/dc
FA equals f_n = 60 Hz and U_{aux} = 18...80 V ac/dc

Power supply and output relay modules:

SPTU 240 R2	RS 911 021 - AA
SPTU 48 R2	RS 911 021 - BA

Dimensions and instructions for mounting

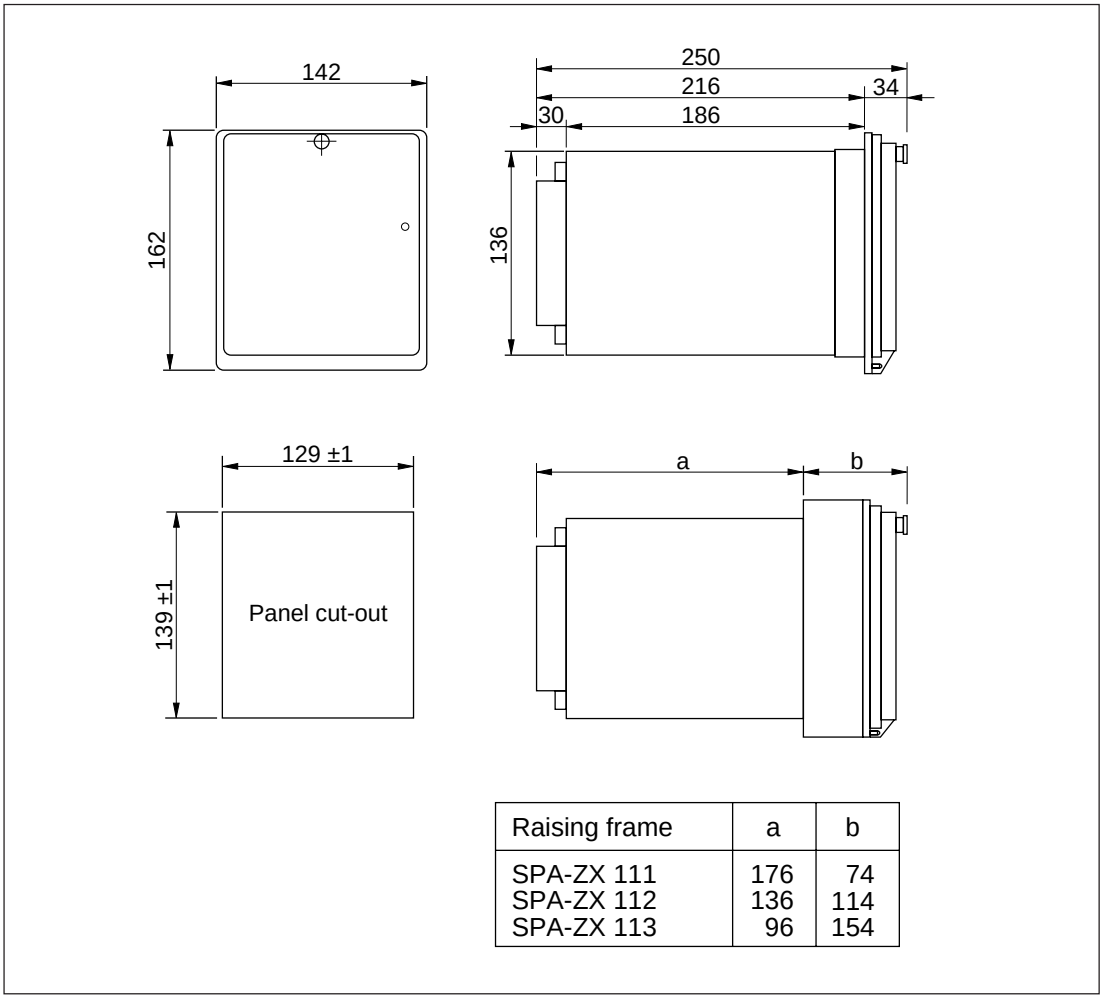
The relay is housed in a normally flush-mounted case. The relay can also be arranged for semi-flush mounting with the use of a 40 mm, 80 mm or 120 mm raising frame, which reduces the depth behind the panel by the same dimension. The type designation of the raising frames are SPA-ZX 111 for the 40 mm frame, SPA-ZX 112 for the 80 mm frame and SPA-ZX 113 for the 120 mm frame. A surface mounting case SPA-ZX 117 is also available.

The relay case is made of an extruded, beige aluminium profile.

A cast aluminium alloy mounting frame with rubber gasket provides a degree of protection by enclosure to IP 54 between the relay case and the panel surface when the relay is panel mounted.

The relay case is completely with a hinged gasketed, clear, UV-stabilized polycarbonate cover with a sealable fastening screw. The degree of protection by enclosure of the cover is also IP 54.

A terminal strip and two multipole connectors are mounted on the back of the relay case to facilitate all input and output connections. To each heavy duty terminal, i.e. measuring input, power or closing output, one 6 mm^2, one 4 mm^2 or one or two 2.5 mm^2 wires can be connected. No terminal lugs are needed. The three signalling inputs are available on a six pole detachable connector and the serial bus connection is using a 9-pin D-type connector.



Raising frame	a	b
SPA-ZX 111	176	74
SPA-ZX 112	136	114
SPA-ZX 113	96	154

Information required with order

1. Quantity and type designation
2. Ordering number
3. Rated frequency
4. Auxiliary voltage
5. Accessories

6. Special requirements

Example
15 pcs SPAJ 160 C
RS 611 051 - AA
f_n = 50 Hz
U_{aux} = 110 V dc
15 pcs matching modules SPA-ZC 21 MM
2 pcs fibre optical cables SPA-ZF MM 100
-

1MRS 750064-MUM EN

ABB Substation Automation Oy
P.O.Box 699
FIN-65101 VAASA
Finland
Tel. +358 (0)10 22 4000
Fax.+358 (0)10 22 41094
www.abb.com/fi